

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A plasma source apparatus for plasma generation by helicon waves, comprising :
 - a. an antenna,
 - b. a plasma generation chamber in the proximity of the antenna,
 - c. a fluid injector for introducing at least one fluid into the plasma generation chamber,
 - d. a radio frequency generator with continuous or pulsed RF power supply,

wherein:

- the source apparatus comprises magnetic field generators arranged around the antenna,
- said antenna comprises at least two conductive loop elements surrounding and spaced along a common longitudinal axis and at least a pair of axial conductive elements electrically interconnecting said conductive loop elements,
- each of said conductive loop elements including at least one capacitor, and

wherein the antenna is structured as a resonant antenna that generates plasma by helicon waves.

2. (Previously presented) A plasma source apparatus according to claim 1 wherein only said conductive loop elements include at least one capacitor.
3. (Cancelled)
4. (Withdrawn) A plasma source apparatus according to claim 1 wherein said conductive loop elements and said axial conductive elements include at least one capacitor.

5. (Previously presented) A plasma source apparatus according to claim 1 comprising several axial conductive elements, each axial conductive element interconnecting said conductive loop elements.

6. (Previously presented) A plasma source apparatus according to claim 1 comprising antenna cooling means such as a chiller, a heat pipe, a Cryo-cooler or a Peltier device.

7. (Previously presented) A plasma source apparatus according to claim 1 comprising thermal control means of the plasma generation chamber in order to avoid thermal shock between the inside and the outside of the plasma generation chamber during plasma ignition.

8. (Previously presented) A plasma source apparatus according to claim 1 comprising a matching network interconnecting the radio frequency generator and the antenna, in such a way as to promote an optimal transfer of radio frequency energy from the radio frequency generator to the antenna.

9. (Withdrawn) A plasma source apparatus according to claim 1 comprising a fixed or a moveable shield, enclosing but disconnected from the antenna which is adapted to define or to adjust in real time an optimal electromagnetic coupling between the antenna and the plasma.

10. (Cancelled)

11. (Cancelled)

12. (Previously presented) A plasma source apparatus according to claim 1 wherein at least one of said capacitors is tunable.

13. (Cancelled)

14. (Previously presented) A plasma source apparatus according to claim 1 wherein at least one of said conductive loop elements is movable.

15. (Withdrawn) A plasma source apparatus according to claim 1 coupled with an optical resonator comprising at least two mirrors (one partially reflecting) placed at the limits of the plasma generation chamber, and wherein the mirrors are aligned to provide multiple reflections of lightwaves.

16. (Withdrawn) A plasma source apparatus according to claim 1 coupled with an apparatus generating cavitation bubbles by ultrasonic waves, the plasma generation chamber containing a liquid from where the bubbles are generated, the apparatus being adapted to induce RF energy into the interior of the acoustic cavitation bubbles for ignition and maintenance of the plasma.

17. (Withdrawn) A plasma source apparatus according to claim 1 coupled with a complementary plasma source as Electron cyclotron resonance source or Ion cyclotron resonance source.

18. (Withdrawn) A plasma source apparatus according to claim 1 coupled with a complementary antenna inside or outside the plasma generation chamber.

19. (Withdrawn) A plasma source apparatus according to claim 1 wherein the antenna is also adapted as a receiving system to perform Nuclear Magnetic Resonance (NMR) Monitoring or analysis of fluid or a workpiece implemented inside the plasma generation chamber.

20. (Previously presented) A plasma source apparatus according to claim 1 wherein each of said axial conductive elements and/or said conductive loop elements are made with volume conductive wire, braids wire, Litz wire, or hollow wire.

21. (Previously presented) A plasma source apparatus according to claim 1 comprising a network of antennas wherein adjacent pairs of conductive loop elements have at least one common axial conductive element.

22. (Withdrawn) A plasma source apparatus according to claim 1, being connected to one or a plurality of process chambers.

23. (Withdrawn) A plurality of plasma source apparatuses according to claim 1, each plasma source being cooperatively connected to at least one process chamber.

24. (Withdrawn) One or a plurality of plasma source apparatuses according to claim 1 comprising a plurality of RF coils, the RF coils being arranged in a circumferential manner proximate to the process chamber(s).

25. (Previously presented) One or a plurality of plasma source apparatuses according to claim 1 wherein at least one RF coil comprises a capacitor.

26. (Withdrawn) One or a plurality of plasma source apparatuses according to claim 22 comprising a plurality of magnets, the magnets being arranged in a circumferential manner proximate to the process chamber(s), to perform NMR inspection of the process chamber and/or the workpiece(s) inside.

27. (Withdrawn) One or a plurality of plasma source apparatuses according to claim 22 comprising a plurality of electrodes defining a Paul trap type or a Penning trap type on which an oscillating voltage is applied.

28. (Cancelled)

29. (Cancelled)

30. (Withdrawn) A plasma source apparatus according to claim 9 wherein the RF shield is adapted to define or to adjust in real time the optimal electromagnetic coupling between the antenna and the plasma.

31. (Withdrawn) A plasma source apparatus according to claim 9 wherein the RF shield is a concentric RF shield about a longitudinal axis of the antenna, and wherein a

frequency tuning is accomplished by mechanically moving the concentric RF shield along said axis.

32. (Previously presented) A plasma source apparatus according to claim 1 wherein the apparatus is adapted such that the antenna has a sinusoidal current distribution in function of the azimuthal angle.